

DIVISION MANAGED BRIDGE FOUNDATIONS - FIELD INVESTIGATION AND DESIGN SCOPING GUIDELINES

North Carolina is divided into three Physiographic/Geologic Provinces; Coastal Plain, Piedmont and Blue Ridge Mountains. Foundation type within these three provinces varies primarily with regard to depth to rock or the lack thereof.

NCDOT Divisions	Primary Foundation Types		
	Coastal Plain	Piedmont	Mountains
1-4, 6 & part of 8	Piles		
5, 7, 9, 10, 12 & part of 8		Piles & Drilled Piers	
11, 13 & 14			Short End Bent Piles, Drilled Piers & Footings

INVESTIGATION SCOPE

For Division Managed Structures the following subsurface investigation guidelines should be considered for estimating purposes. Number and depth of borings may vary depending on information required by the design engineer. In all cases the foundation design engineer should be consulted prior to and during the field investigation to ensure adequate and pertinent information is obtained.

Coastal Plain

The subsurface investigation for most Coastal Plain bridges can be limited to two (2) borings per structure; one (1) at each end bent. Depending on the length of the structure and variability in the subsurface, additional borings at the interior bent(s) may be required. Boring depths should be estimated at 100 feet per boring. During the drilling phase the field professional should be in frequent contact with the design engineer to adjust the number and depth of borings as necessary.

Piedmont

Boring depths in the Piedmont can vary greatly. For estimating purposes 75 feet per boring should be used. This depth should offset the cost of any coring when required. For Piedmont investigations at least one (1) boring should be performed per bent location. Depending on the bridge geometry and subsurface conditions additional borings may be necessary. In the Piedmont there is the potential to encounter shallow rock which may require coring for drilled pier or footing design (see coring guidelines below). The field professional should relay boring information to the design engineer during the investigation so boring criteria can be adjusted based on subsurface conditions and design requirements.

Mountains

In the Mountain province the presence of shallow rock is likely and short end bent pile, footing or drilled pier foundations are common. For estimate purposes two (2) borings per

bent to a depth of 20 feet should be used. In addition, fifteen (15) of rock core per bent should also be included in the estimate (see coring guidelines below). As in other areas it is important for the field professional to report unexpected changes in subsurface conditions to the design engineer.

Coring Guidelines

The depth of coring in rock will typically be determined in the field using the core RQD. The guideline below reflects embedment criteria for drilled piers from the top of the rock unit and allows for a nominal safety margin on lateral stability:

RQD%	RANGE OF CORE DEPTH (FEET)
> 75	10 - 15
50 - 75	15 - 20
25 - 50	20
< 25	20 - 25

DESIGN SCOPE

1. Design all bridge foundations in accordance with the NCDOT LRFD Foundation Design policy.
<http://www.ncdot.org/doh/preconstruct/highway/geotech/LRFDPolicy/>
2. Recommend pile, drilled pier or spread footing foundations for structures with regard to axial resistance, lateral stability, buckling analysis for piles, scour, settlement, downdrag and constructability.
3. Recommend maximum resistance for spread footings considering the effects of adjacent foundations, water table, scour, etc. The scour critical elevation for a spread footing shall be at the bottom of footing elevation.
4. Include in the geotechnical recommendations report a summary table of the bridge foundation recommendations including the following:
 - a. WBS project number, TIP number, county, description and bridge station and alignment
 - b. Bent (work point) stations, types of foundations, factored resistance, bottom of cap or footing elevations, estimated pile lengths and tip elevations
5. Address the following items, when applicable, as notes on plans or comments and attach to the summary table:
 - a. All appropriate notes on plans (**Reference NCDOT Structure Design Unit's Standard Foundation Notes on Plans**)
<http://www.ncdot.org/doh/preconstruct/highway/geotech/provnote/>
 - b. End slope inclination and extent of slope protection
 - c. Waiting periods for approach slab construction or end bent construction
 - d. Battered piles
 - e. Point of fixity elevations

- f. Design and scour critical elevations
- g. Tip elevations
- h. Steel pile points for steel piles or steel pile tips for concrete piles
- i. Number and location of test piles or piers, load tests, dynamic and / or static testing
- j. Required rock socket for drilled piers
- k. Need for permanent steel casing including casing tip elevations, SPT, SID Inspection, CSL and slurry use in accordance with the current NCDOT *Drilled Piers Special Provision*
- l. Range of estimated hammer energies for concrete and pipe piles

Address any other items affecting the foundation design on the summary sheets and include all final recommendations on the summary sheets.

For Private Engineering Firm designed projects please forward the submittals for the Geotechnical Engineering review to the following addresses:

Divisions 1-7

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